

**"NOCTUA C-NIGRUM" IN EASTERN NORTH AMERICA, THE
DESCRIPTION OF TWO NEW SPECIES OF XESTIA HÜBNER
(LEPIDOPTERA: NOCTUIDAE: NOCTUINAE)**

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Abstract.—The species formerly called *Amathes c-nigrum* (L.) or *Noctua c-nigrum*, the "spotted cutworm" of economic literature, is shown to be two species in North America, a smaller species, *Xestia adela*, n. sp., and a larger species, *Xestia dolosa*, n. sp.; *adela* is the species more like the Eurasian *c-nigrum*. The two species have different distributions, but occur together over a large area of southeastern Canada and northeastern United States; *adela* occurs in most of the Canadian provinces, Alaska, the conterminous United States, and Mexico, whereas *dolosa* is known only from southeastern Canada and the northeastern and north central United States.

This study had its inception in the fall of 1969 when André Comeau brought me two lots of three moths each of a small and large species, both then called *Amathes c-nigrum* (Linnaeus, 1758), that had been taken at Geneva, New York in sex pheromone traps, one set baited with cis-7-tetradecenyl acetate and the other with trans-7-tetradecenyl acetate (Roelofs and Comeau, 1970).

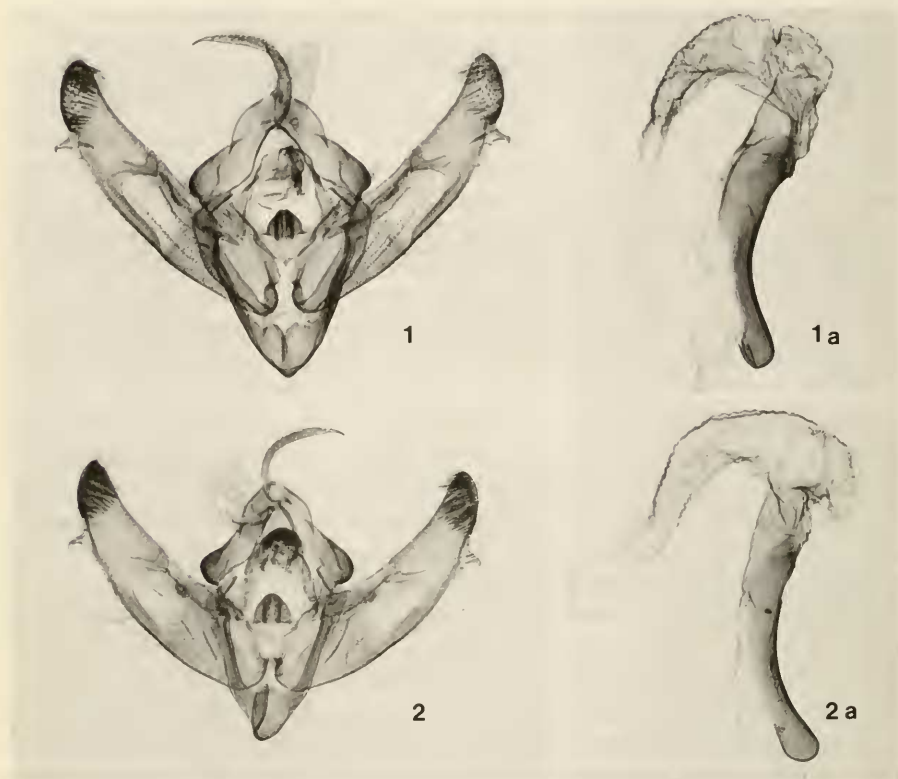
In 1946 I had decided that specimens of *Amathes crassipuncta* (Wileman and South, 1928) that I thought were *c-nigrum* when collected in Baguio, Mountain Province, Luzon, Philippines, during May and June of 1945 were different from both European and New York State specimens of "*c-nigrum*." I also decided that the New York species, I then had only specimens of the "large species," was distinct from the central European species. It was not until 1954 that I first took a specimen, a male, of the "small species" at McLean Bogs Reserve, Tompkins County, New York; the specimen was placed with the series of the "large species," but it was turned at right-angle to draw attention to its smaller size and seemingly brighter color and different emphasis of the pattern when compared with other male moths in the series. In 1955 I began a succession of summers, sometimes the springs and falls also, away from Ithaca, and no more attention was given to *c-nigrum* until André Comeau brought the specimens of what were obviously two species.

In the spring of 1970 I moved to a rural area near Ithaca, and inasmuch as it appeared to be ideal for working on the problem of the two "*c-nigrum*" species, I decided to try to determine if both species occurred in the area, and, if they did, to try to rear them. I operated two fifteen watt blacklights in two different places behind the house. My surprise was great when the small species proved very abundant and the large species relatively uncommon, but not rare. During the springs and summers of 1970 through 1973, inclusive, and again in 1975 several lots of both broods of each species were reared. Although I could find no differences between the larvae of the two species except size, the resulting moths in each lot left no doubt that two discrete species were present. Later George Godfrey examined the larvae, but with the same result; he could find no evident structural differences.

The number of chromosomes was also investigated. The haploid number of the European *Xestia c-nigrum* is 29 (Bigger, 1961: 88, fig. 7; pl. 1, fig. 7). John E. Rawlins, a graduate student in systematic entomology at Cornell University, made chromosome counts for me of the two eastern North American species in the spring of 1979 and found that the haploid number for each of the new species was 29, like *c-nigrum* and different from that of many species of Noctuidae in which the number is 31.

The study of older collections has not proved very illuminating for apparently two reasons, both attributable to the commonness of "*c-nigrum*." Most collectors satisfied their need or desire for a series of the moth in a very few nights of collecting and in a single season; further, if other areas were visited for collecting, "*c-nigrum*" was not a species that was collected since it was common at home. What little examination that I have done has tended to indicate that most of the specimens of "*c-nigrum*" in older, eastern collections are the large species.

I believe that there are habitat differences between the two species, and Don Lafontaine, in conversation, has agreed with this assessment. The larger species seems more likely to be taken in old, wooded areas with clearings and roads, and the smaller species seems common in open areas, pastureland, meadows, and agricultural cropland. This is true at Ithaca where the larger species is common in woodland areas and the smaller species abundant in meadows and cropland. There also seems to be an indication of at least an initial difference in the geographical distribution of the two species; the smaller one seems to have a more extensive and western distribution and the larger a more restricted eastern distribution. If it were not for a few early records of the small species in the east, I would be inclined to postulate a range extension for the smaller species, an invasion of the range of the larger by the smaller. In this context the possibility that the phenomenon that we observe today may have had its origin in past periods of glaciation must also be considered, range separation, evolutionary change, and post glaciation range extensions of both the small and large species. However,



Figs. 1, 1a. *Xestia dolosa*. 1, Paratype; Six Mile Cr., Ithaca, N.Y., 29 Aug. 1954, J. G. Franclemont; male genitalia, aedeagus removed, JGF genitalia slide 5577; Franclemont Collection. 1a, Aedeagus of Fig. 1. Figs. 2, 2a. *X. adela*. 2, McLean Bogs Reserve, Tompkins Co., N.Y., 12 July 1954, J. G. Franclemont; male genitalia, aedeagus removed, JGF genitalia slide 5575; Franclemont Collection. 2a, Aedeagus of Fig. 2.

I think that the present habitat preferences will prove the more important element in determining the range, past and present, actual and potential, of the two species.

With the assistance and direction of Ring Cardé two series of pheromone traps baited with *cis*-7-tetradecenyl acetate and *trans*-7-tetradecenyl acetate in varying combinations were set out along hedge rows near my house. Although the moths had been coming to the blacklights by the hundreds before the experiment was started and came in equally large numbers after the discontinuation of the experiment, very few moths came to the pheromone traps, and the separation was not as neat as that achieved by André Comeau in his study. Wendell Roelofs and Ring Cardé thought that this

might be attributable to some differences in the synthesis of the pheromones.

After becoming convinced that two species did exist, the first question was one of available names. It was known that a number of varietal names had been proposed for forms and geographical races of *c-nigrum* and that some closely related species had been described from the Oriental Region, Hampson, 1902, *Agrotis deraiota*, Ceylon; A. E. Prout, 1928, *Agrotis latinigra*, Sumatra; Wileman and South, 1928, *Agrotis crassipuncta*, Luzon; Holloway, 1976, *Amathes isolata*, Borneo; all are now referable to the genus *Xestia* as NEW COMBINATIONS. However, no available names applicable to the North American species were uncovered. Guenée (1852, vol. 5, p. 328) commented on the noticeably darker hind wing of the American population, the larger species?, but stated that the pattern was otherwise so similar that he would not be so bold as to make a separate species. Tutt (1892, vol. 2, p. 111) proposed a name, *suffusa*, for Guenée's North American form, but this name is a primary homonym.

The general appearance of the moths of the *c-nigrum* group is so similar and so well known that the descriptions of the two new species will be, for the most part, comparative. It is hoped that the illustrations of the moths and of the genitalia will prove sufficient to distinguish the species. After one has studied both species in series, there is usually little question as to which species any given specimen should be referred.

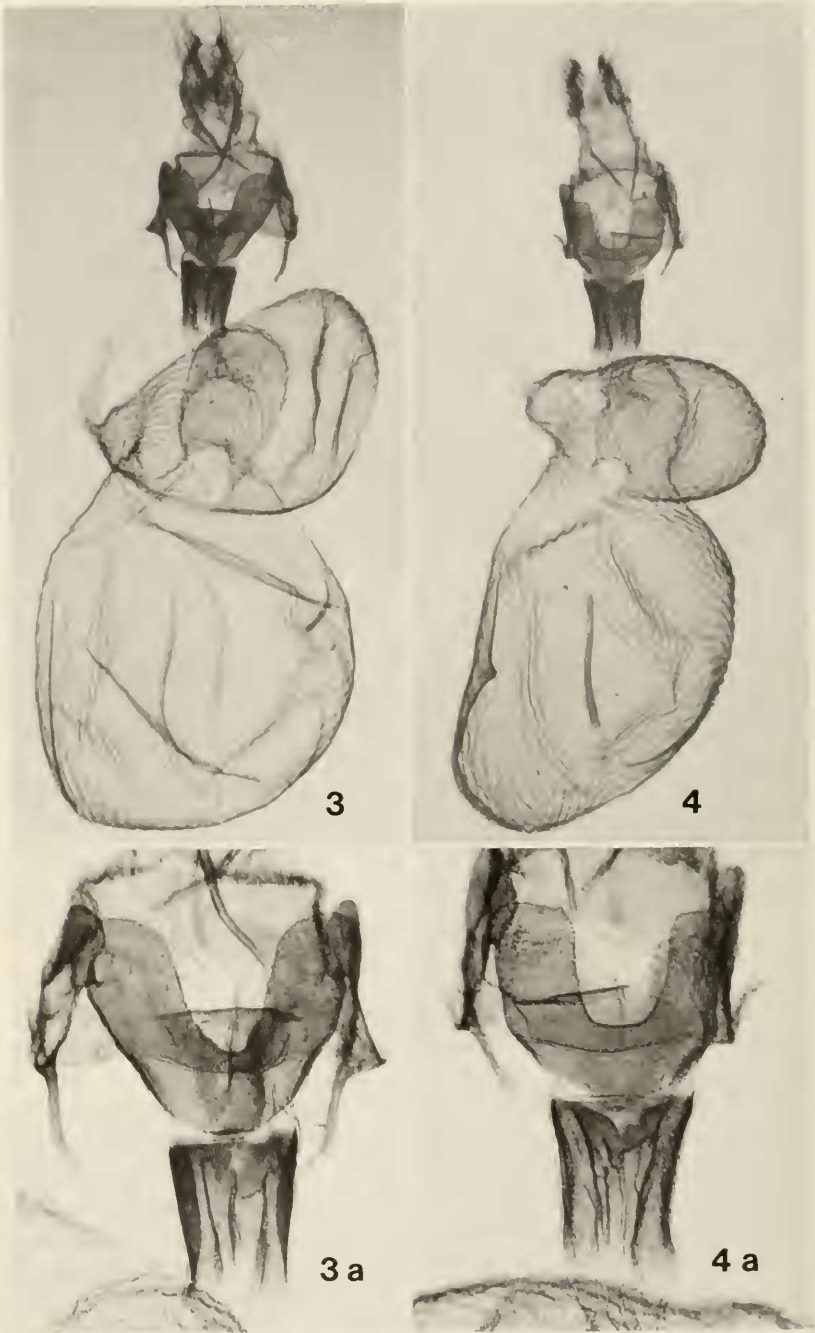
This study has been restricted to the populations in eastern North America, but series of specimens have been examined from the West, especially northern Arizona, Montana, and British Columbia and also a few specimens from Mexico and Alaska. All the western material seen seemed to be referable to the small species, *adela*.

Xestia dolosa Franclemont, NEW SPECIES

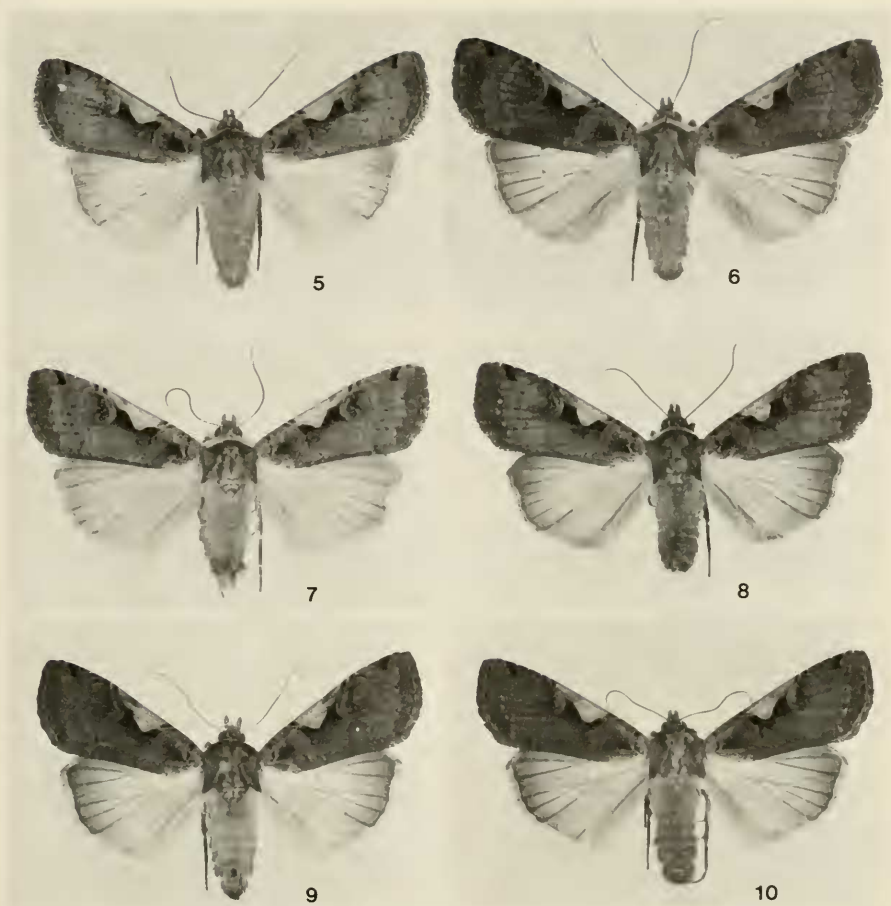
Figs. 1, 3, 5-10

?*Noctua c-nigrum* var. B. Guenée, 1852, Histoire Naturelle des Insectes, Species Général des Lépidoptères, 5 Noctuélites, 1): 328. Locality: "Amérique Septentrionale. Coll. Bdv. et Dbdy."

?*Noctua c-nigrum* var. *suffusa* Tutt, 1892, The British Noctuae and their Varieties, 2: 111. Preoccupied by *Noctua suffusa* Fabricius, 1787 (= *Noctua suffusa* [Denis & Schiffermuller, 1775; *Nomen nudum*]). In addition Tutt used *suffusa* as a varietal name in two other species of *Noctua*, *sobrino* Duponchel, 1843, on page 107, and *glareosa* Esper, 1788, on page 108. Tutt proposed *suffusa* for *Noctua c-nigrum* var. B. Guenée, 1852. *Noctua c-nigrum*; sensu Holland, 1903, The Moth Book, 183 (*pars*), pl. 22, fig. 1. An excellent color photograph of a female of the "large species."



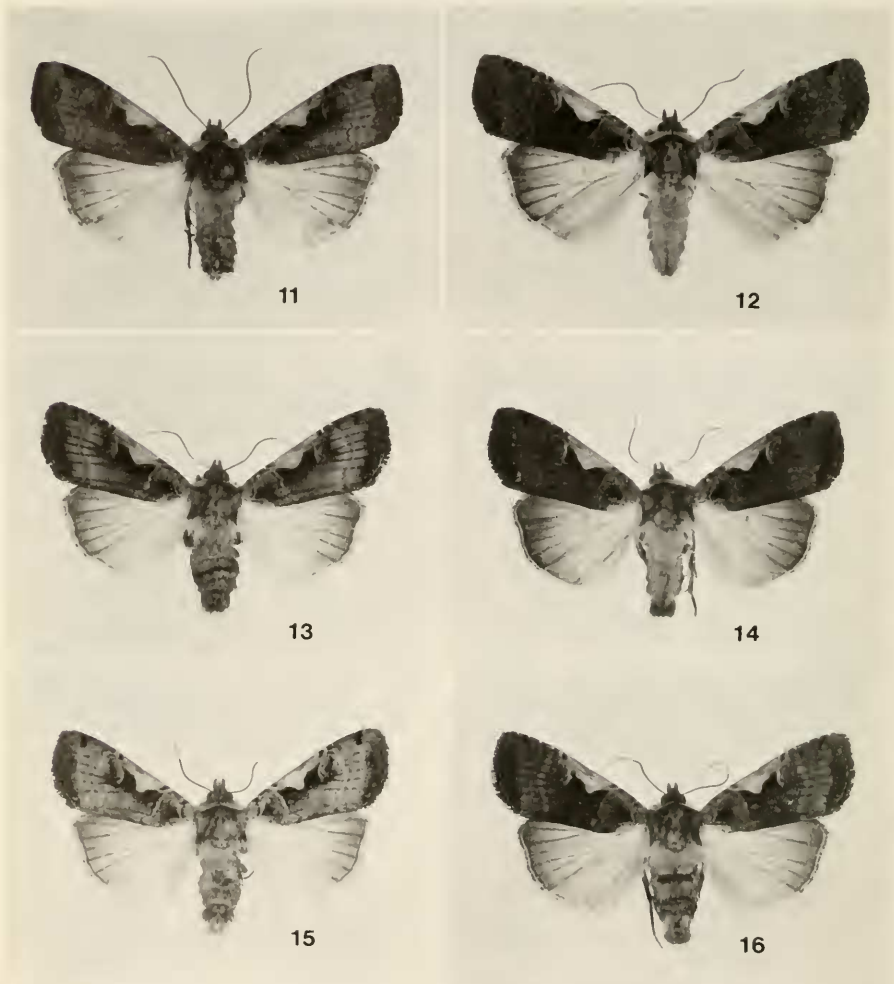
Figs. 3, 3a. *Xestia dolosa*. 3, Paratype; Ithaca, N.Y., 25 Aug. 1935, J. G. Franclemont; female genitalia, JGF genitalia slide 6784; Franclemont Collection. 3a, Ventral ostial plate and ductus bursae of Fig. 3 (reversed). Figs. 4, 4a. *X. adela*. 4, Paratype; Snyder Heights, 1100 ft., Ithaca, N.Y., 7 Sept. 1972, J. G. Franclemont; female genitalia, JGF genitalia slides 6298; Franclemont Collection. 4a, Ventral ostial plate and ductus bursae of Fig. 4 (reversed).



Figs. 5-10. *Xestia dolosa*. All collected by J. G. Franclemont and in Franclemont Collection. 5, Male; Wrangle Brook Road, Lakehurst, N.J., 15 June 1955. 6, Female; same locality, 14 June 1955. 7, Paratype male; Snyder Heights, 1100 ft., Ithaca, N.Y., 9 Sept. 1972. 8, Paratype male; same locality, 5 Sept. 1972. 9, Paratype female; same locality, 8 Sept. 1972. 10, Paratype female; same locality, 2 Sept. 1975.

This species is larger, darker, and less contrastingly marked than *c-nigrum*; it is also larger, exhibits less contrast in the pattern and colors, and is generally duller and a little lighter in appearance than *adela*. The excavation in the ostial plate of the female as well as the plate itself are V-shaped, not subquadrate or U-shaped as in *c-nigrum* and *adela* respectively.

Male.—General color of head, thorax, and fore wings dark rose-brown; palpi black, 3rd segments and apices of 2nd segments gray; patagia bone-



Figs. 11–16. *Xestia adela*. All from Snyder Heights, 1100 ft., Ithaca, N.Y., collected by J. G. Franclemont and in Franclemont Collection. 11, Paratype male; 10 June 1979. 12, Paratype female; 21 June 1973. 13, Male; 28 Aug. 1973. 14, Female; 4 Sept. 1973; 15, Male; 21 Aug. 1973. 16, Female; 23 Aug. 1973.

color, apices ground color; tegulae with apices and outer margins black; disc of thorax with gray-tipped tuft behind patagia, tuft at base with scales gray to bone-color at tips; fore wing with basal area between basal and t. a. lines blackish gray; basal line black, followed by a black wedge-shaped mark; t. a. line double, slightly irregular to 2A, then looped outwardly;

claviform a small, black loop to a small black dot in fold; t. p. line varying from conspicuous, double, lunulate, and pale to a vague, single lunulate dark line, outwardly curved from costa to M_3 , then incurved to inner margin; s. t. line with conspicuous, inwardly angled, black spot at costa, vague from spot to inner margin, parallel to outer margin; area between s. t. and terminal lines grayish black; terminal line a series of small, black wedges; orbicular an open C-shaped or V-shaped spot, much paler than ground color, grayish bone-color to brownish flesh-color, open side connected with a similarly colored costal area just above orbicular or extending almost to t. a. and t. p. lines; reniform with a black annulus, an inner lunule, upper angle with a reddish rust shade; hind wing fuscous, darker on outer $\frac{1}{4}$, veins and terminal line much darker, fringe dark with pale base and pale outer line; abdomen dark gray; fore wings below gray with pale costal stripe to t. p. line, t. p. line indicated by a dark shade; hind wing below grayish yellow-white, dark at apex, t. p. line as on fore wing; legs with apices of femora white, apices of tarsal segments white.

Female.—Markings as in male, but ground color of fore wing dull black, t. a. and t. p. lines less evident; hind wing darker fuscous than that of male; abdomen with anal tuft reddish; below as in male.

Fore wing length.—Spring brood, 19–22 mm; total wing expanse, as spread, 38–43 mm, varying with angle of fore wings. Summer brood, 18–21 mm; expanse, 37–43 mm.

Male genitalia.—As figured; typical for the genus *Xestia*; sacculus of valve with exterior margin exceeding costal margin of valve.

Female genitalia.—As figured; ostial plate V-shaped, excavation of plate also V-shaped.

Larva.—Length, 40–42 mm; color varying from green to gray brown; narrow, broken, pale subdorsal lines, best developed at anterior end; a broad, pale, lateral stripe often with pinkish shading, spiracles in upper margin; dorsum with a series of chevronlike markings, increasing in size and intensity toward posterior end, those on A7 and A8 most conspicuous, that on A8 the last; head with a reticulate pattern with irregular dark bands adjacent to adfrontals and continued on vertex.

Type.—♀; Snyder Heights, 1100 ft., Ithaca, Tompkins County, New York, 18 August 1975, reared from ovum, food *Taraxacum officinale* Weber, J. G. Franclemont; female genitalia slide 6293, JGF; Franclemont Collection.

Paratypes.—Spring (first) brood, various dates in May and June; Ithaca, Tompkins Co., New York, 3 ♂, 7 ♀; Cornell Campus, Ithaca, Tompkins Co., New York, 1 ♀; Snyder Heights, 1100 ft., Ithaca, Tompkins Co., New York, 4 ♂, 5 ♀. Summer–Autumn (second) brood, various dates in August, September, and October; Ithaca, Tompkins Co., New York, 5 ♂, 12 ♀;

Cornell Campus, Ithaca, Tompkins Co., New York, 1 ♂, 2 ♀; Six Mile Creek, Ithaca, Tompkins Co., New York, 6 ♂, 11 ♀; Snyder Heights, 1100 ft., Ithaca, Tompkins Co., New York, 35 ♂, 39 ♀, and reared 34 ♂, 56 ♀; collected or reared by J. G. Franclemont; Franclemont Collection.

In addition to the paratypes a large number of specimens from various other localities have been examined. The species has been seen from Nova Scotia to as far south as the mountains of North Carolina and as far west as Grand Forks, North Dakota, and Independence, Missouri.

Xestia adela Franclemont, NEW SPECIES

Figs. 2, 4, 11–16

Noctua c-nigrum; sensu Lutz, 1918, 1921, Field Book of Insects, pl. 51. A drawing by Mrs. Beutenmuller of a male of the "small species."

Amathes c-nigrum; sensu Rockburne and Lafontaine, 1976, The Cutworm Moths of Ontario and Quebec. Can. Dep. Agric. Publ. 1593: 31, 121, fig. 124. The figure appears to be from a female of the first or spring brood of the "small species."

This species is very similar in general appearance to the European *Xestia c-nigrum* of which it may eventually be proved a race. The female genitalia exhibit some differences in the ostial plate, but all the female specimens of *c-nigrum* before me are from the British Isles and Germany; East Asian specimens may show that the differences are the opposite ends of a cline. From *dolosa* the species may be separated by its somewhat smaller size, especially evident in summer or second brood specimens, its tendency in the male to a somewhat marbled appearance of the fore wing and in the female to a deeper, more brilliant hue of the black. The ostial plate has the excavation U-shaped, and the plate itself is more U-shaped than triangular. The male tends to have the sacculus of the valve less expanded, but there is some overlap between the two species in the development of this character.

Male.—Pattern of fore wing as in *dolosa*; ground color brighter rose-brown, usually somewhat marbled in appearance; t. a. and t. p. lines usually conspicuous, double, varying from paler than ground to ground color; orbicular with a more pinkish hue; hind wing paler, more yellowish fuscous; below as in *dolosa*, but pale costal stripe less evident.

Female.—Pattern of fore wing as in *dolosa*; ground color more intense black with some reddish highlights (viewed with microscope 10–15×); hind wing somewhat lighter than that of *dolosa*.

Fore wing length.—Spring brood, 16–19 mm; expanse, 32–38 mm. Summer brood, 15–18 mm; expanse, 29–37 mm.

Male genitalia.—As figured, somewhat smaller than those of *dolosa*; sacculus of valve usually less expanded.

Female genitalia.—As figured; excavation of ostial plate U-shaped.

Larva.—Length 30–35 mm (as in *dolosa*, this length is for larvae reared in the laboratory and that produced second brood moths of the same size as those taken at light); color and pattern as for *dolosa*, not distinguishable from that species in the characters examined, but overall smaller.

Type.—♀; Snyder Heights, 1100 ft., Ithaca, Tompkins County, New York, 25 August 1973, J. G. Franclemont; female genitalia slide 6299, JGF; Franclemont Collection.

Paratypes.—Spring (first) brood, various dates in June, but 1 ♂, 31 May; Snyder Heights, 1100 ft., Ithaca, Tompkins Co., New York, 27 ♂, 23 ♀. Summer-Autumn (second) brood, various dates in August and September; Snyder Heights, 1100 ft., Ithaca, Tompkins Co., New York, 264 ♂, 196 ♀; the paratypes of the second brood have been limited to specimens collected in 1972; collected by J. G. Franclemont; Franclemont Collection.

The male referred to previously from McLean Bogs Reserve was taken 12 July 1954; a female was taken at the same locality 14 July 1956.

More than 2,000 specimens in addition to the paratypes have been studied. The range of this species covers most of the northern United States and most of the Canadian provinces. In the East I have seen it from as far south as Maryland; in the West I have seen at least single specimens from almost all the states. The species was frequent at West Fork, elevation 6500 feet, Coconino County, Arizona, in 1961, 1964, and 1965. The most southern station is southeast of Teopica on Highway 24 in Chiapas, Mexico; these last specimens are in the Canadian National Collection, Ottawa.

I do not know which of the two species under the name of the "spotted cutworm" has caused damage to crop plants in the Northeast, but I believe both probably have. Unless specimens of the moths were reared and saved from larval infestations, I do not think that it will be possible to determine the species involved in causing the damage. West of the Mississippi River any damage can probably be attributed to *adela*.

The following paper by Anne Hudson and L. P. Lefkovich (1980) gives data that support and corroborate the evidence from the pheromone studies by Roelofs and Comeau, from rearing, and from the male and female genitalia. It and this paper essentially form parts of a single unit.

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Classey and his friends for their kindness in sending me specimens of *Xestia c-nigrum* from the British Isles. The photographs are by the author.

LITERATURE CITED

- Bigger, T. R. L. 1961. Chromosome numbers of Lepidoptera—Part II. Entomol. Gaz. 12: 85–89, pl. 1.
- Guenée, A. 1852. In Boisduval, J. A. D. and A. Guenée, Histoire Naturelle des Insectes, Species Général des Lépidoptères, 5 (Noctuérites, 1). Paris, Roret. 407 pp.
- Hudson, A. and L. P. Lefkovitch. 1980. Two species of the *Amathes c-nigrum* complex (Lepidoptera: Noctuidae) distinguished by isozymes of adenylate kinase and by selected morphological characters. Proc. Entomol. Soc. Wash. 82: 587–598.
- Roelofs, W. L. and A. Comeau. 1970. Lepidopterous sex attractants discovered by field screening tests. J. Econ. Entomol. 63: 969–974.
- Tutt, J. W. 1892. The British Noctuae and their varieties, vol. 2. London, Warne and Son. 180 pp.